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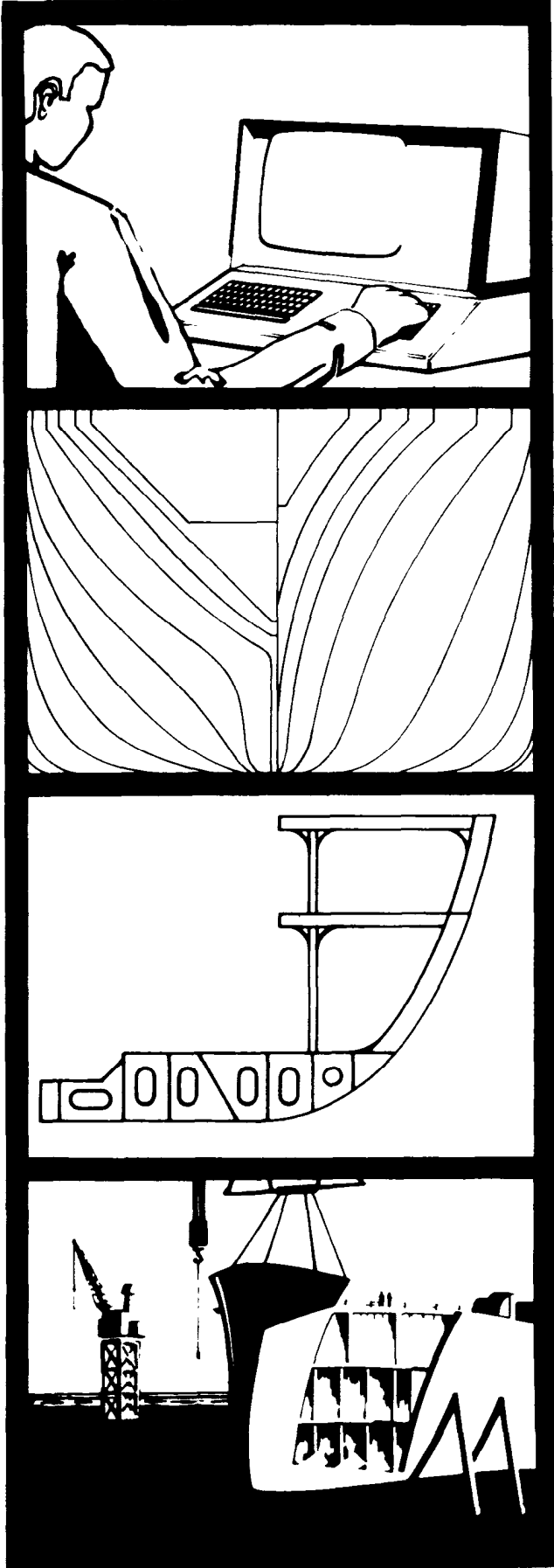
Proceedings of the REAPS Technical Symposium

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U.S. DEPARTMENT OF THE NAVY
CARDEROCK DIVISION,
NAVAL SURFACE WARFARE CENTER

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R ESEARCH
 AND
E NGINEERING
 FOR
A UTOMATION
 AND
P RODUCTIVITY
 IN
S HIPBUILDING

Proceedings of the

REAPS Technical Symposium

October 14-16, 1980

Philadelphia, Pennsylvania

STEERBEAR 3 WITH INTERACTIVE GRAPHICS

Kai Holmgren
Managing Director
Kokums Computer Systems AB

Mr. Holmgren's main task is supervision of the integrated computer-based systems STEERBEAR and SYSTEM Q, which are used at Kokums and at a number of other yards throughtout the world. He holds a degree in Economics. Past experience includes the position of system analyst at the Swedish Aircraft Company, and head of engineering computer applications at the Swedish Aero-engine company.
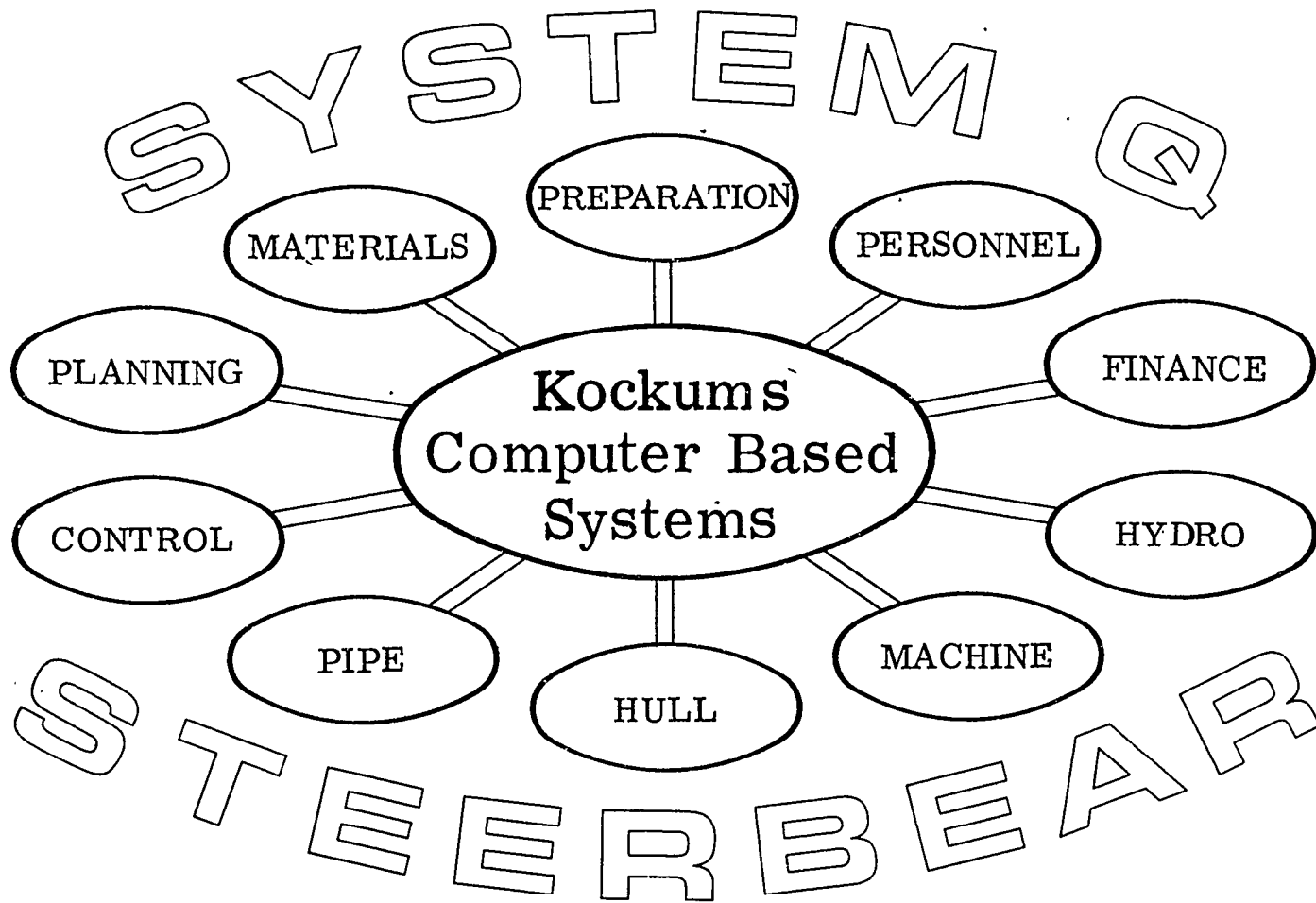
ABSTRACT

The development of the next generation of STEERBEAR (SB 3) is underway. The efforts are concentrated on general basic software adapted to interactive graphics and suited to a variety of applications and in particular to a new STEERBEAR HULL system (SBH 3). The main new features of SBH 3 will be:
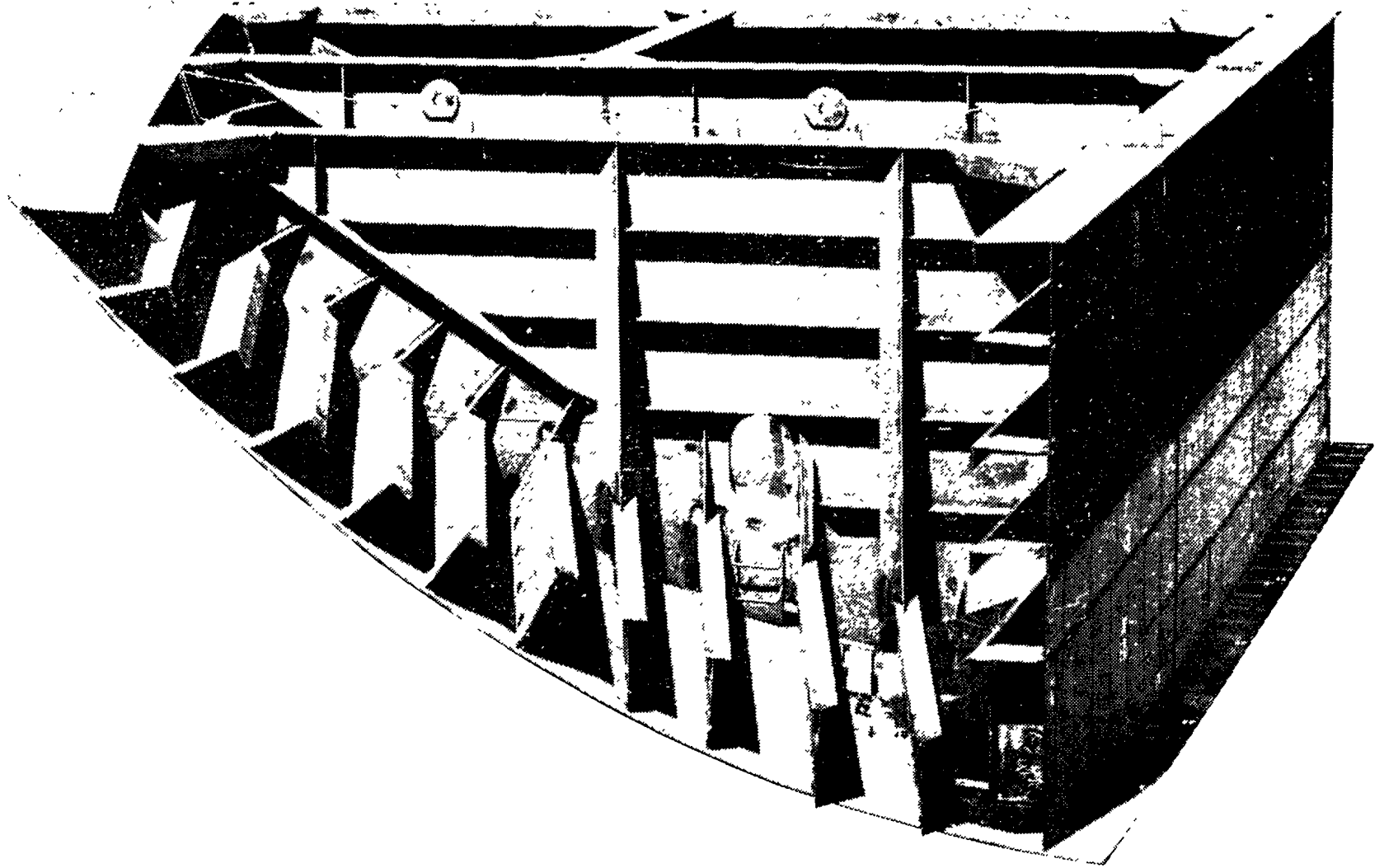
- Interactive graphics available where feasible.

- Improved facilities for generation and handling of three-dimensional curves and surfaces.

- Parametric design modules covering more complex elements than in SBH 2.

- Improved facilities to create and use a 'product description'.

- Distribution of the computer work between main frames, mini- and microcomputers.

A system work station is composed of a Digital Equipment microcomputer, a Tekronix storage tube with refresh capability, an alphanumeric screen and a graphic tablet. Basic graphic software has been developed and is operational on the work station. Within a few months the system work station will be used to present graphic output from SBH 2. The computers used are a PDP 11/34 and an IBM main frame.

During the first quarter of 1981 a system for interactive working drawing composition will be in operation connected to SBH 2. Text and drawings generated by the current structure generation system can be combined and supplemented at the work station and then be returned to the main frame for further processing. The total development program of SBH 3 including basis interactive fairing and interactive nesting will be finished before the end of 1982.

SYSTEM Q

STEERBEAR

MATERIALS

PREPARATION

PERSONNEL

PLANNING

FINANCE

Kockums Computer Based Systems
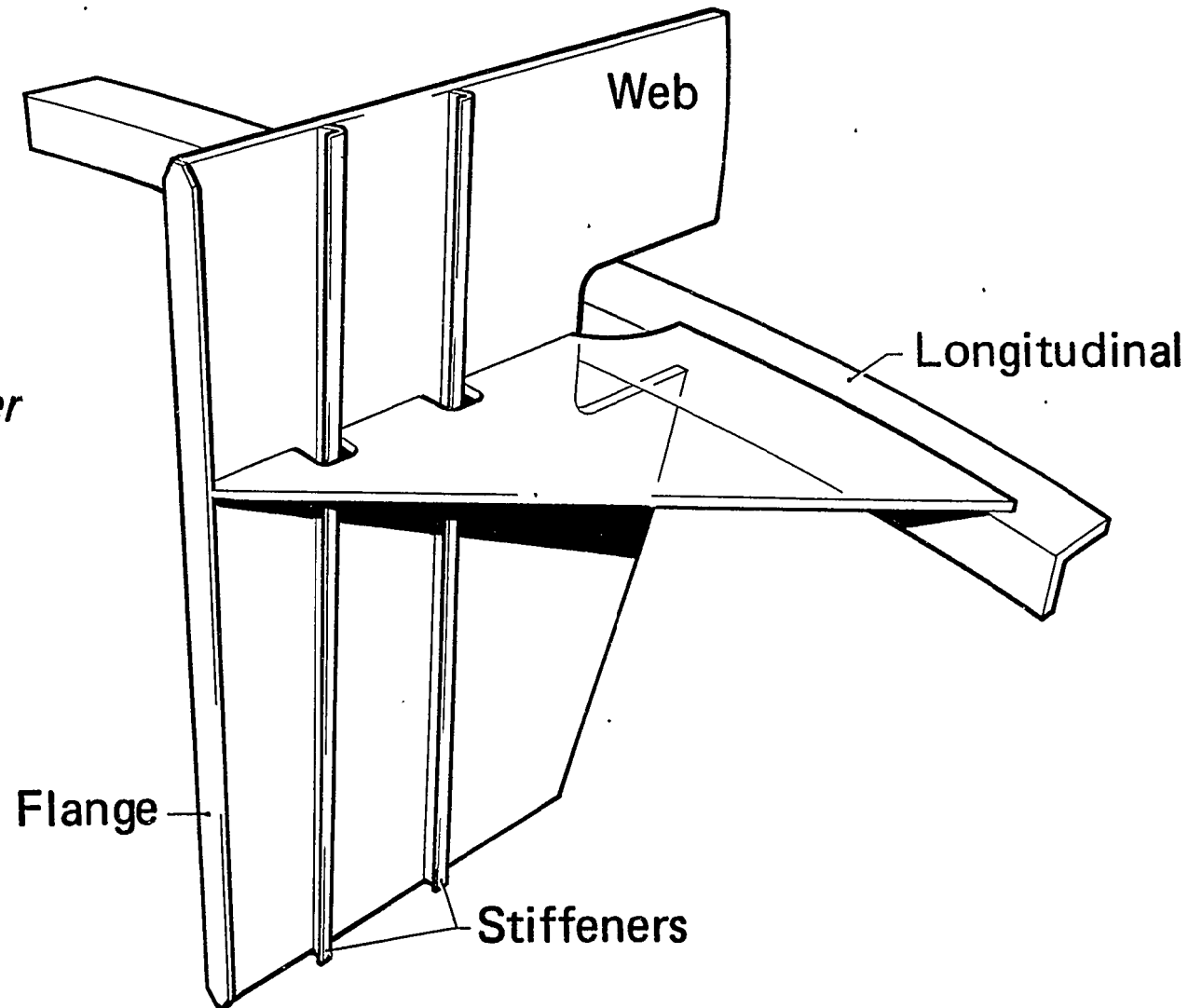
CONTROL

HYDRO

PIPE

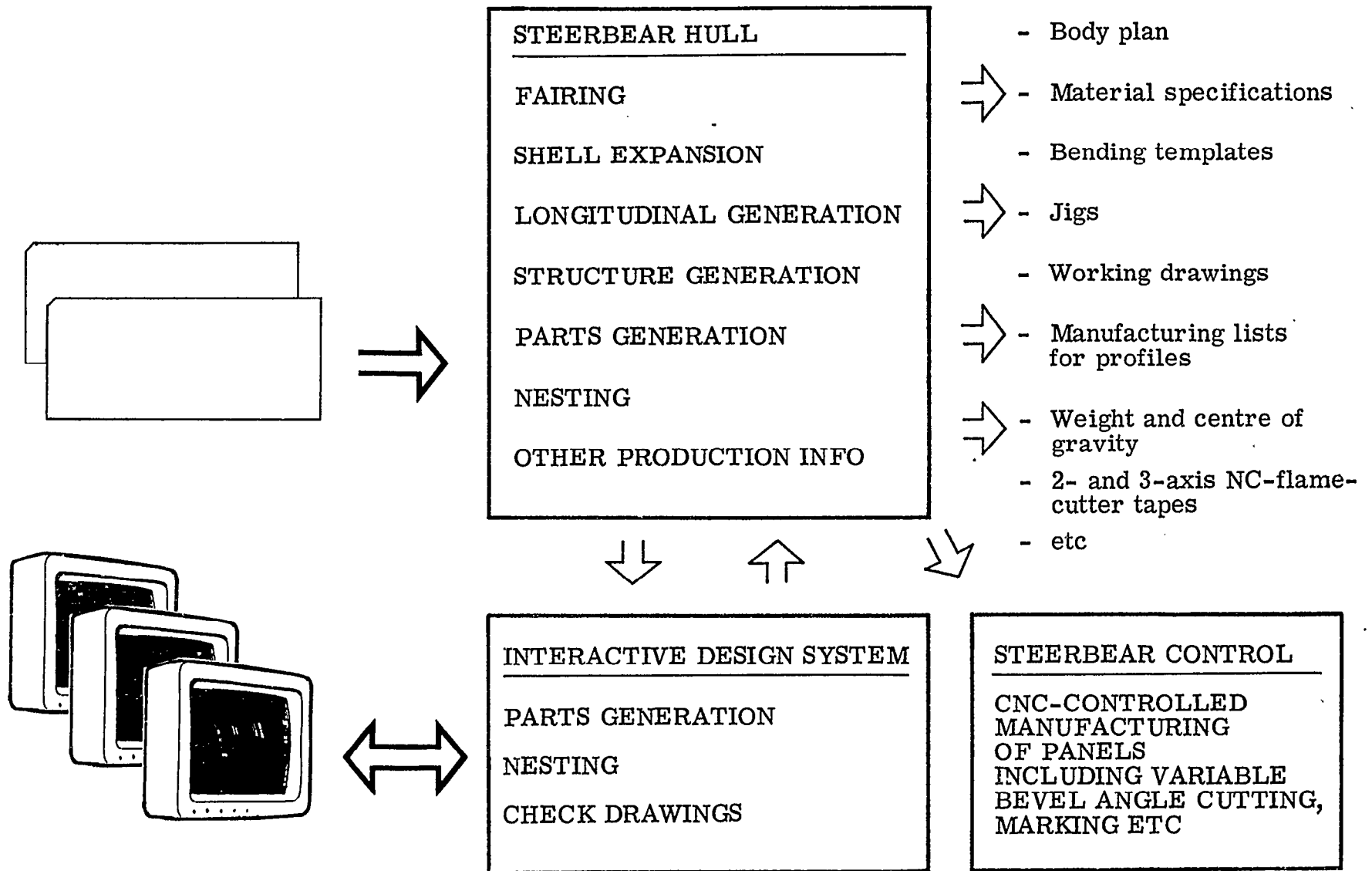MACHINE

HULL

222

The panel concept

Tripping bracket

Input:

- *Connection code*
- *Longitudinal number*
- *Thickness*
- *Side*
- *Quality*

Result:

The bracket generated and stored

Web
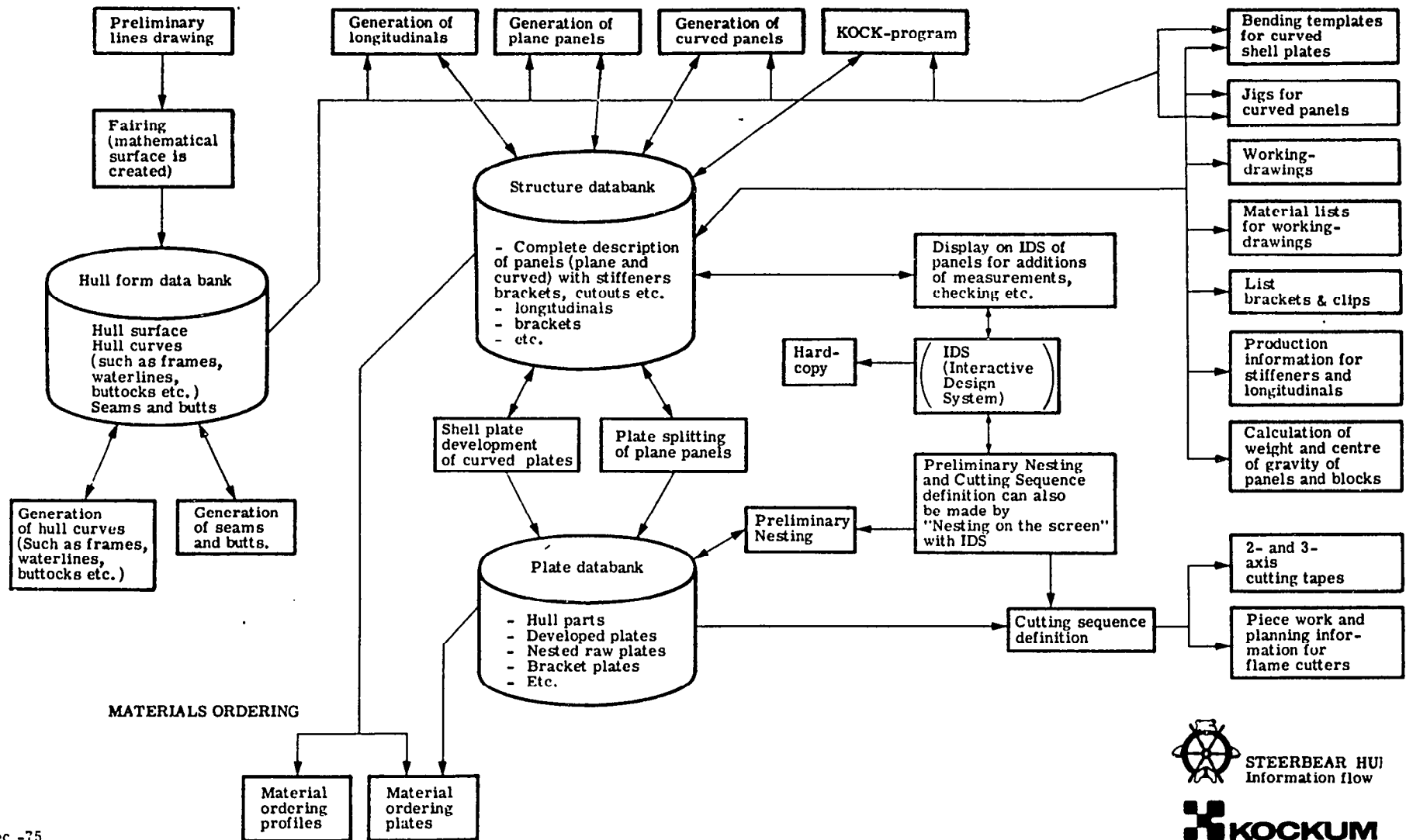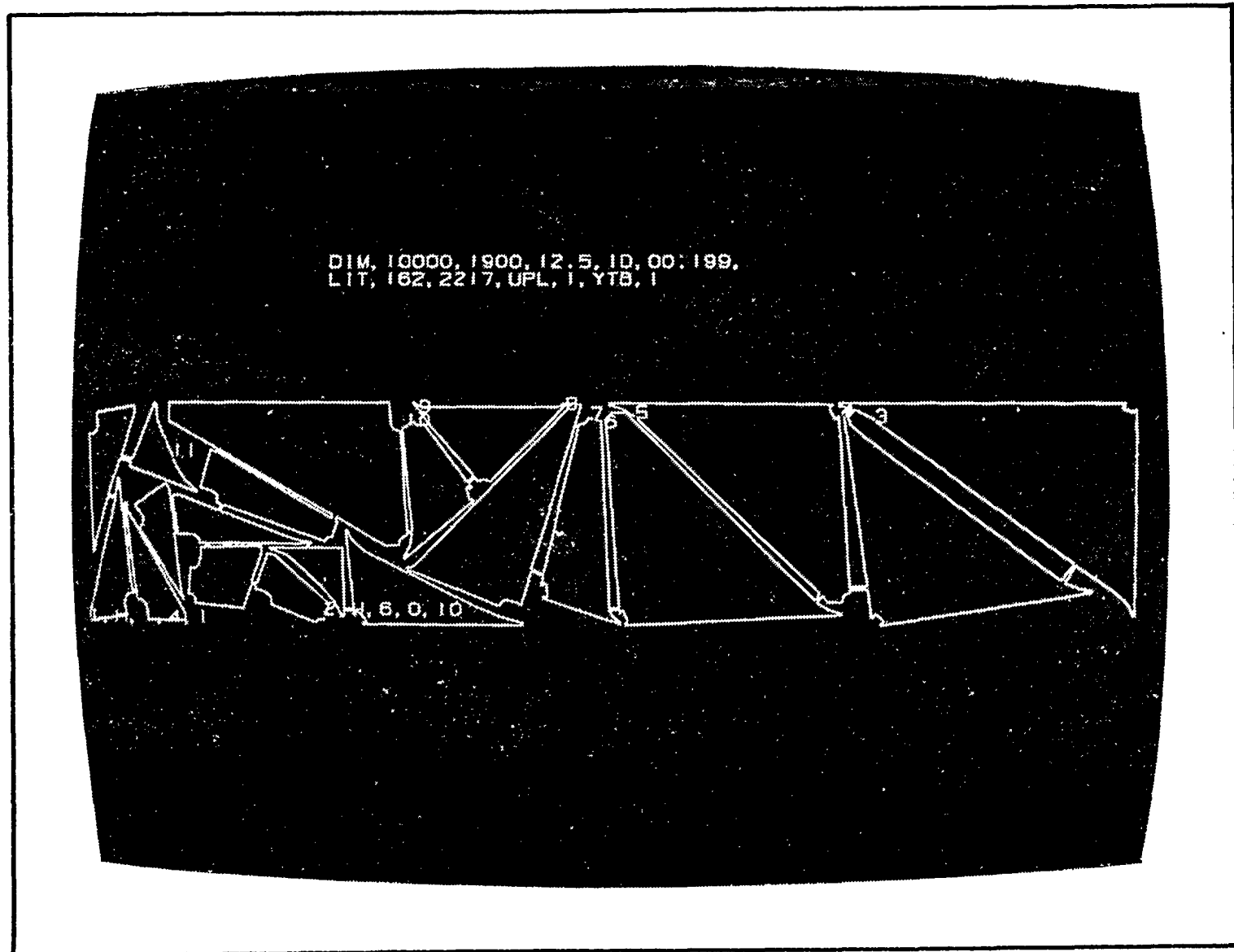
Longitudinal

Flange

Stiffeners

224

STEERBEAR HULL

FAIRING

SHELL EXPANSION

LONGITUDINAL GENERATION

STRUCTURE GENERATION

PARTS GENERATION

NESTING

OTHER PRODUCTION INFO

- Body plan
- Material specifications
- Bending templates
- Jigs
- Working drawings
- Manufacturing lists for profiles
- Weight and centre of gravity
- 2- and 3-axis NC-flame-cutter tapes
- etc

INTERACTIVE DESIGN SYSTEM

PARTS GENERATION

NESTING

CHECK DRAWINGS

STEERBEAR CONTROL

CNC-CONTROLLED
MANUFACTURING
OF PANELS
INCLUDING VARIABLE
BEVEL ANGLE CUTTING,
MARKING ETC

- Preliminary lines drawing

- Generation of longitudinals
- Generation of plane panels
- Generation of curved panels
- KOCK-program

- Fairing (mathematical surface is created)

Structure databank
- Complete description of panels (plane and curved) with stiffeners brackets, cutouts etc.
- longitudinals
- brackets
- etc.

Hull form data bank
Hull surface
Hull curves
(such as frames, waterlines, buttocks etc.)
Seams and butts

- Bending templates for curved shell plates
- Jigs for curved panels
- Working-drawings
- Material lists for working-drawings
- List brackets & clips
- Production information for stiffeners and longitudinals
- Calculation of weight and centre of gravity of panels and blocks

Display on IDS of panels for additions of measurements, checking etc.

Hard-copy

IDS (Interactive Design System)

Generation of hull curves (Such as frames, waterlines, buttocks etc.)

Generation of seams and butts.

Shell plate development of curved plates

Plate splitting of plane panels

Preliminary Nesting and Cutting Sequence definition can also be made by "Nesting on the screen" with IDS

Preliminary Nesting

Plate databank
- Hull parts
- Developed plates
- Nested raw plates
- Bracket plates
- Etc.

Cutting sequence definition

- 2- and 3- axis cutting tapes
- Piece work and planning information for flame cutters

MATERIALS ORDERING

- Material ordering profiles
- Material ordering plates

226

STEERBEAR HUI
Information flow

KOCKUM

Dec -75

Complete nesting

DIM, 10000, 1900, 12.5, 10, 00:199,
LIT, 162, 2217, UPL, 1, YTB, 1

Longitudinal bending table
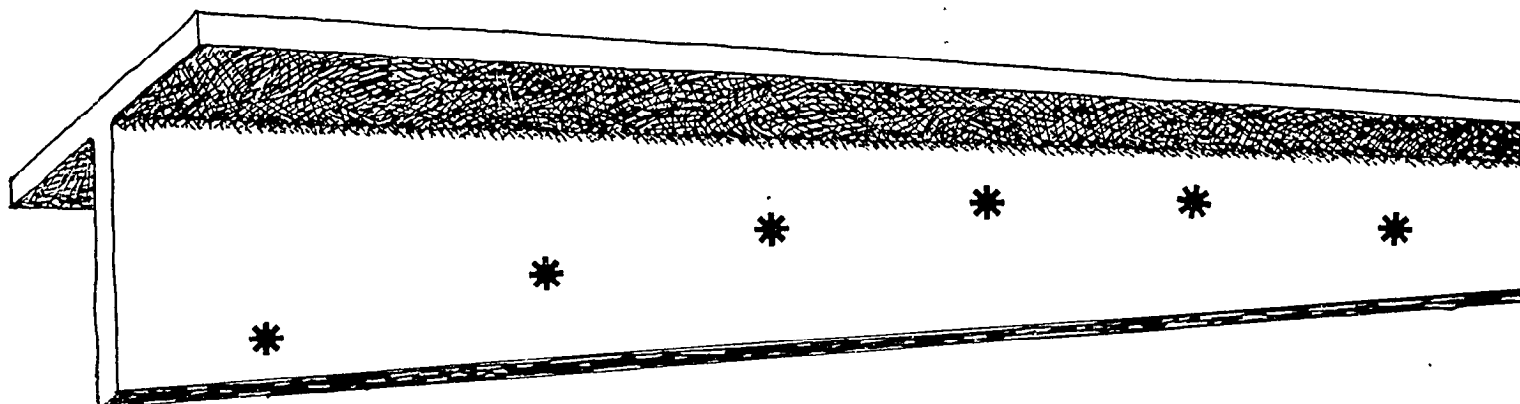
```
  KOCKUMS MEK. VERKSTADS AB     MANUFACTURING LIST FOR LONGITUDINALS    DRAWINGNR    PRODUCTNR   SPNR  .WONR      PLU   PAGE
  TS109A * STEERBFAR 2 BY KMV *                  750507                 122/30252/-      510552   122   2331  23371      1

                  / S S  / P S /         /               E  N  D  C  U  T  C  O  D  E
RNR-GNR-PNR LENGTH /DS AS /DS AS/ WEIGHT/     TYPE     MARK      A    B    C  R1  R2    V1  V2  V3    V4     BEVL  BEVF
==============================================================================================================================
222-3-3       14731 /-- -- / 1 --/  1223 /   *1*  21   AFT                    75          90.0  90
- - - - - - - - - - - - - - - - - - - - /   *2*  21                                       90.0  30
TYPE/DIM:31/500*120*13.5*35.0            /
BYINGMARK :451215                        /
                    +++++ H O L E +++++
HE150*75        V=53    U=3108,10394,13392
```
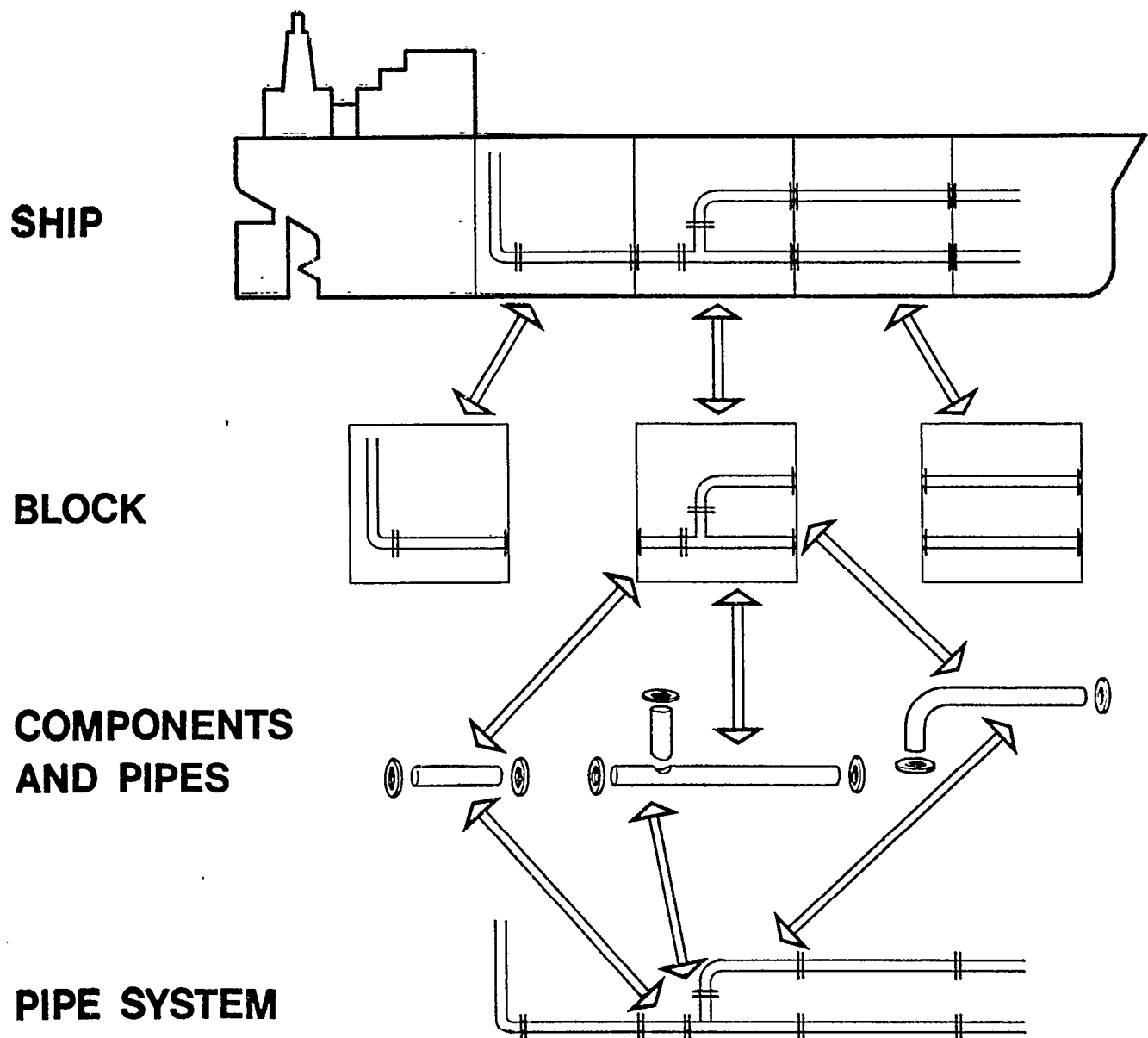
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                            B E N D I N G   T A B L E

             ==================================================================
             /               /               /               /               /
             /DIST HEIGHT /DIST HEIGHT /DIST HEIGHT /DIST HEIGHT /
             /               /               /               /               /
             ==================================================================
             /               /               /               /               /
             /          331 /  4000   335 /  8000   338 / 12000   337 /
             /               /               /               /               /
             /     500   332 /  4500   335 /  8500   338 / 12500   336 /
             /               /               /               /               /
             /    1000   332 /  5000   336 /  9000   338 / 13000   335 /
             /               /               /               /               /
             /    1500   333 /  5500   336 /  9500   338 / 13500   334 /
             /               /               /               /               /
```

STEERBEAR PIPE
– Data Bank Structure

SHIP

BLOCK

COMPONENTS AND PIPES

PIPE SYSTEM

Requirements on Engineering

Lower
design costs

Engineering

Shorter
lead times

Earlier supply of adequate
information to
planning, scheduling,
material ordering etc.
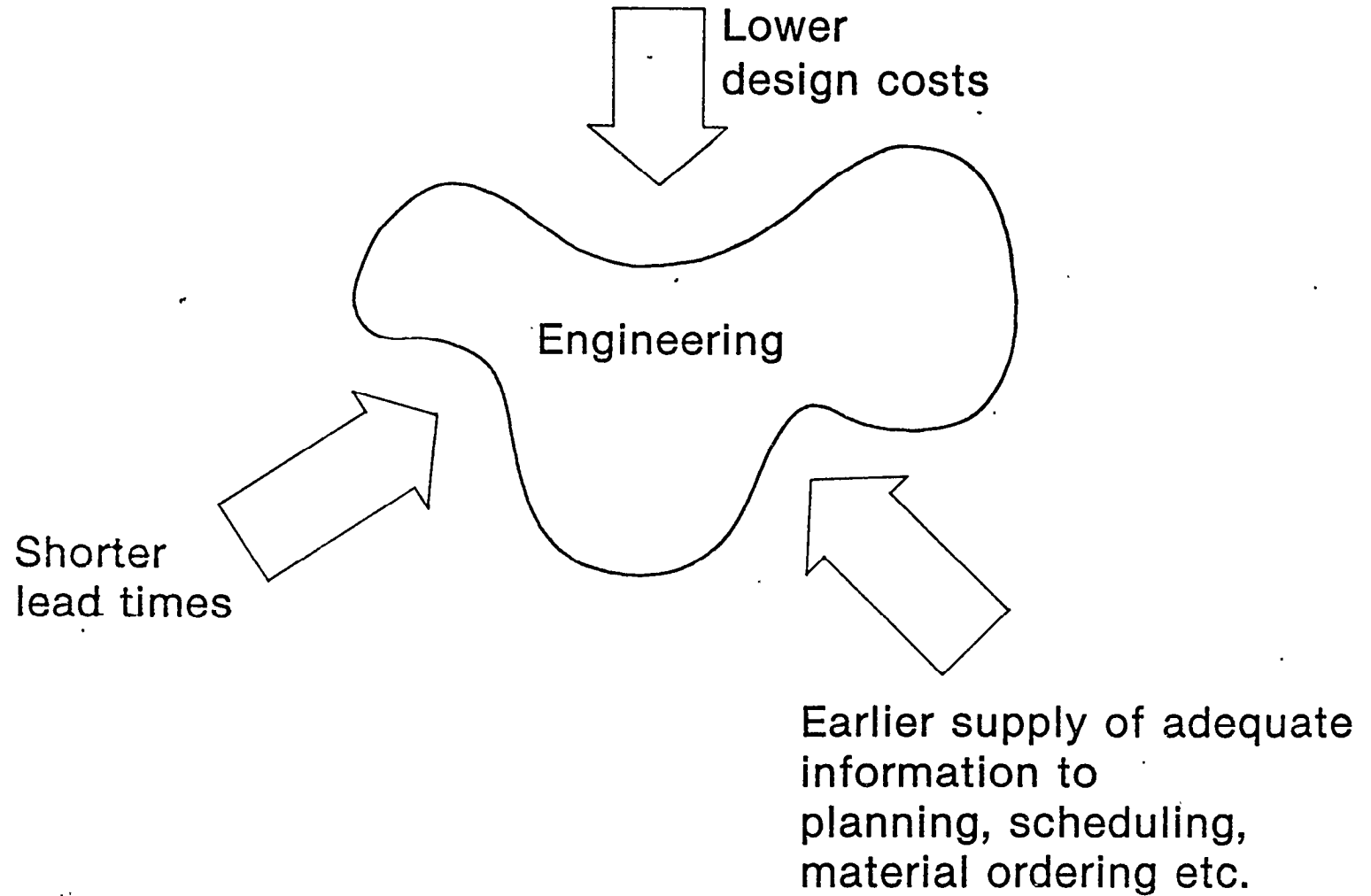
Computerized Drawing Oriented System

Draw-
ings

Pro-
duction
infor-
mation

NC/CNC
tape

Bill of
material etc
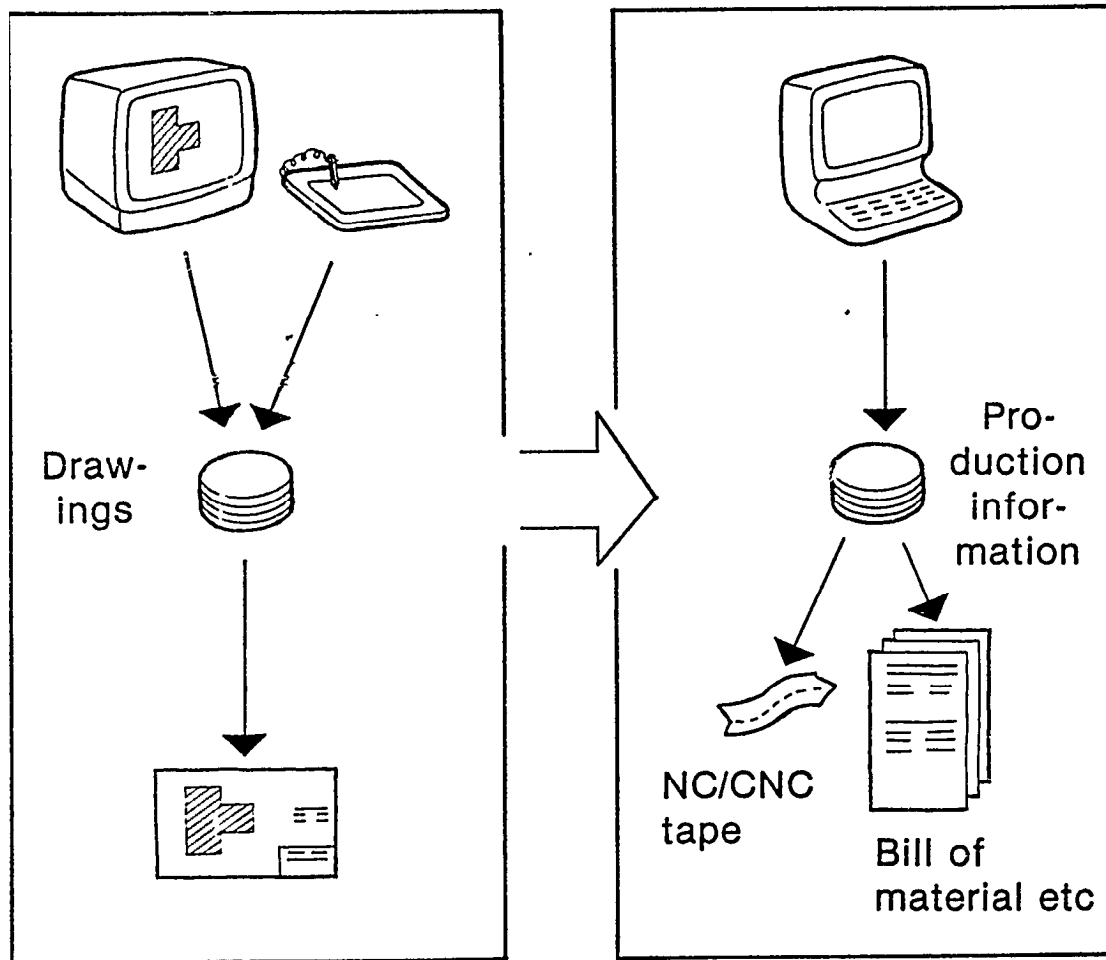
Two different systems
or two isolated functions
of one system

The product is repres-
ented in the system
as drawings.

Great efforts required
to create production
information.

Computerized Product Oriented System

232

Product description

Link to production (NC/CNC etc)
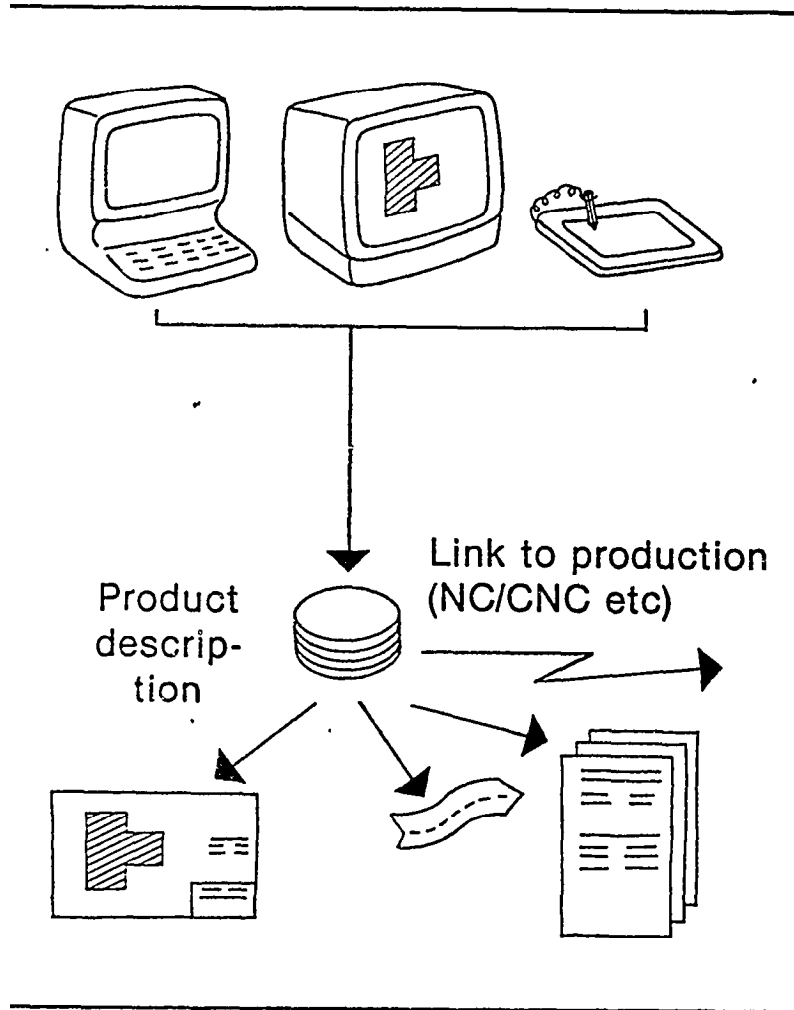
One integrated system with a common data base for all functions.

The product is represented in the system as a product description, ie a physical (in 3D) and functional description with connected administrative data.

Drawings and other production information are derived from the product description.

Drawing oriented system

Product oriented system

BRACK

WEB

LONG

STIFF
FLANG

New possibilities

New computer techniques
New methods

System

Experience

Requirements

New Computer Techniques

Computer networks

Distributed data processing

Interactivity
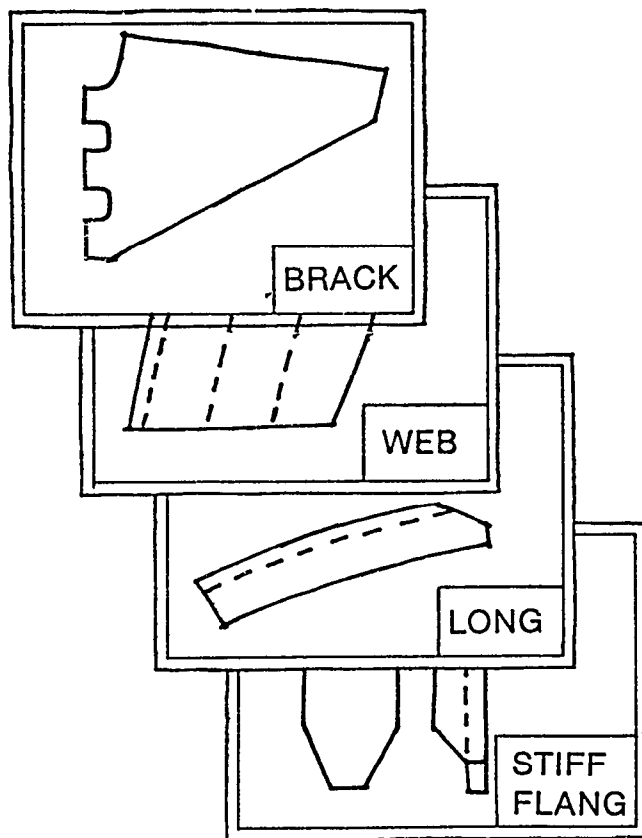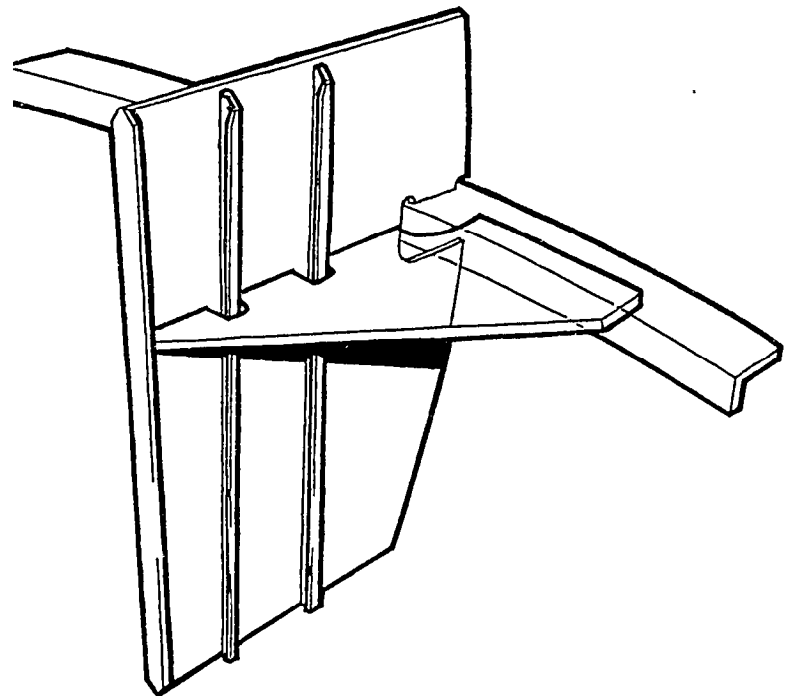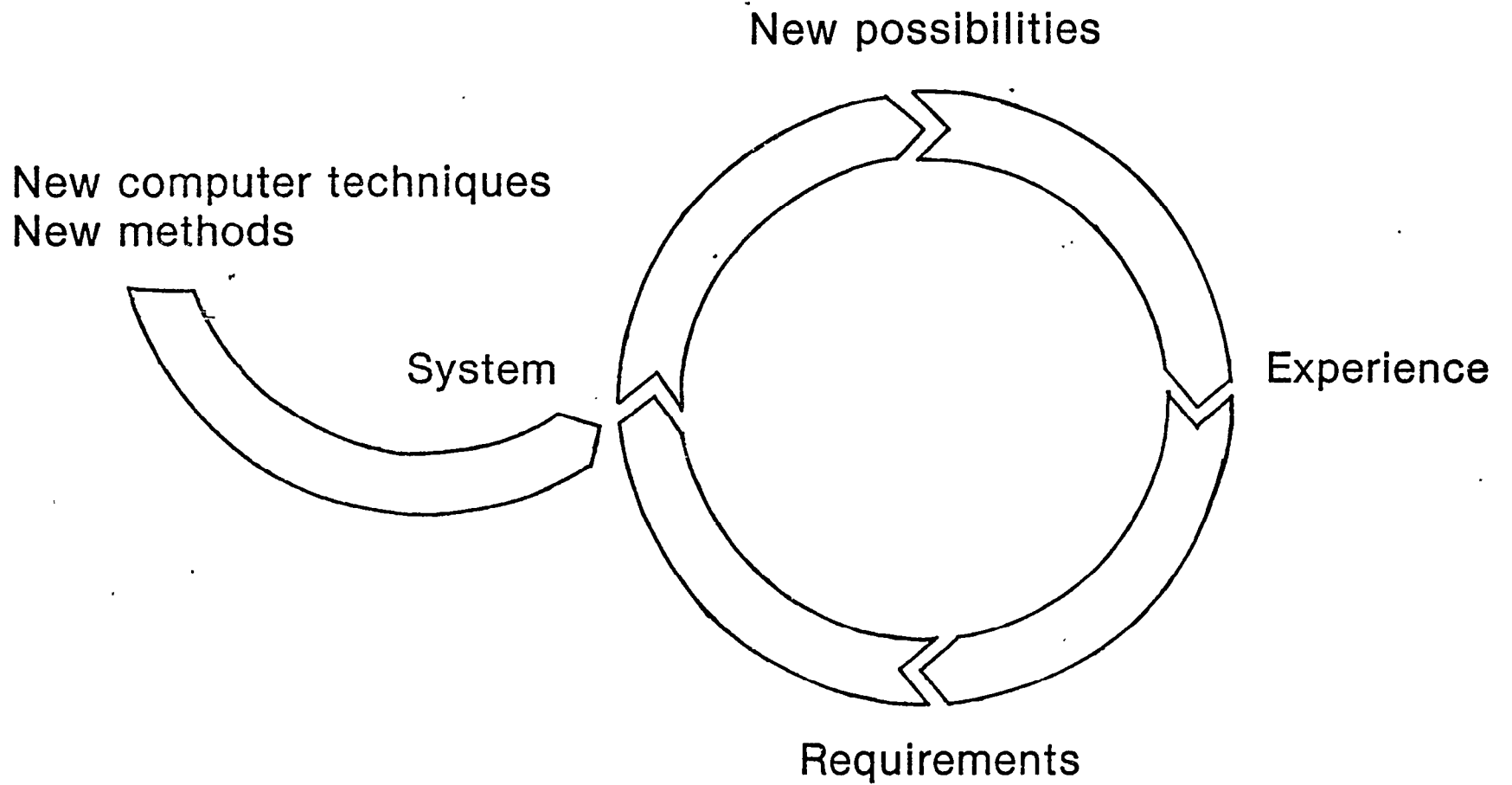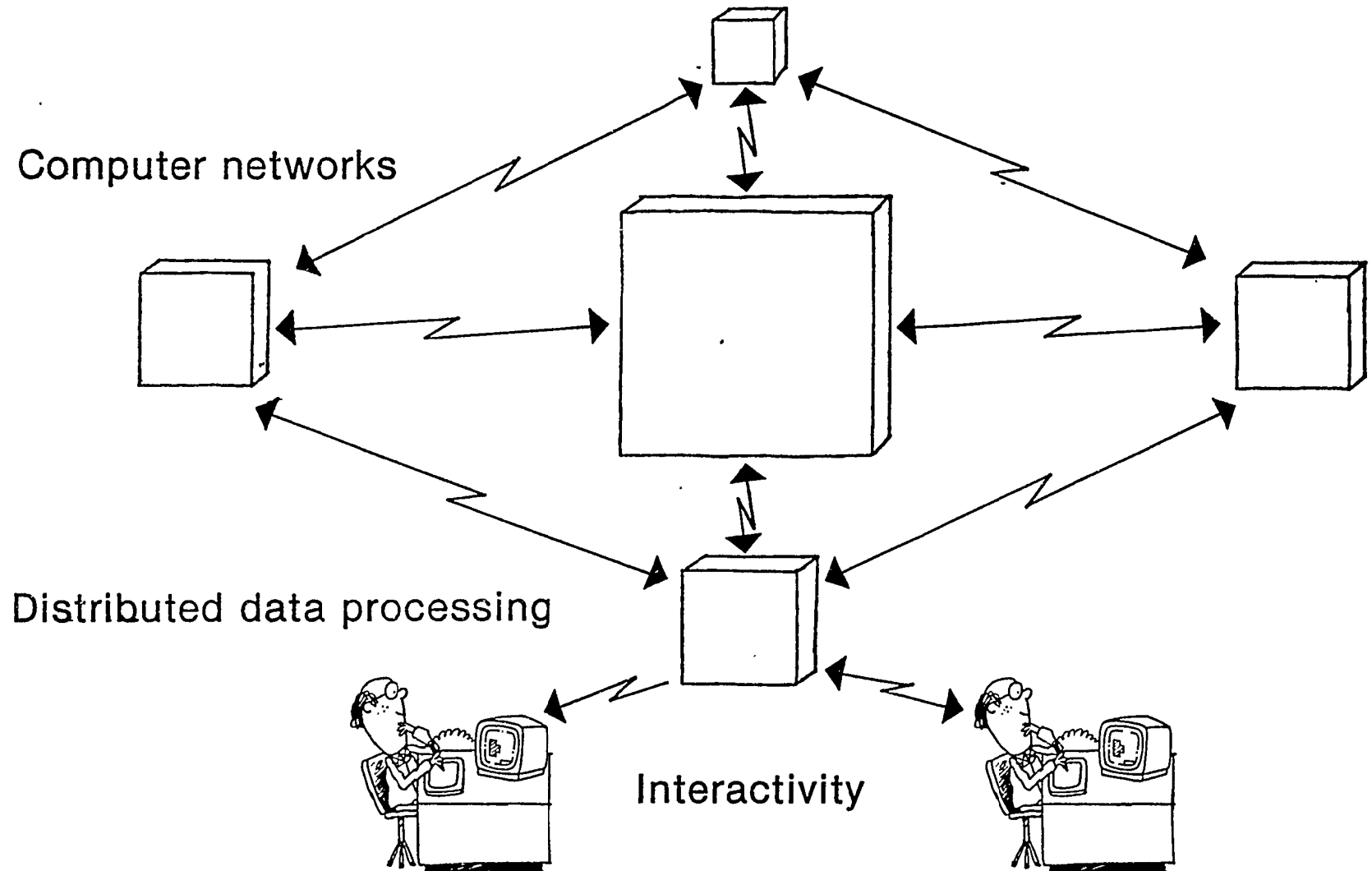
Engineering Workload Reduction

1970's

Design language
Standards

1980's

Design modules

Interactivity

Extended facilities
for product description

STEERBEAR
HULL 2

STEERBEAR
HULL 3

236

System Components

Man - machine communication

Design language

Standards
Design modules

Data bank with
product description
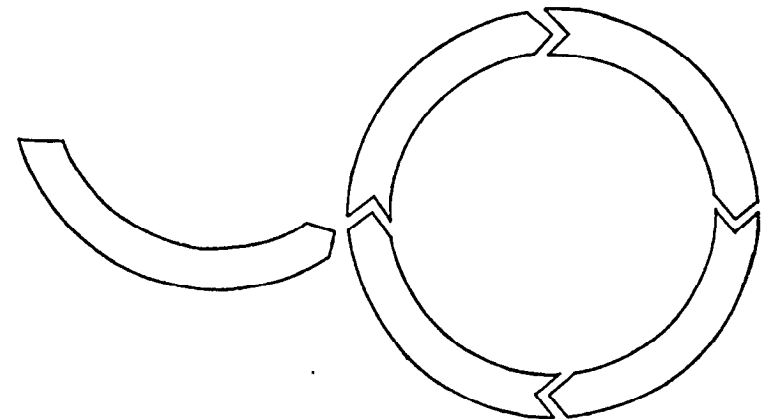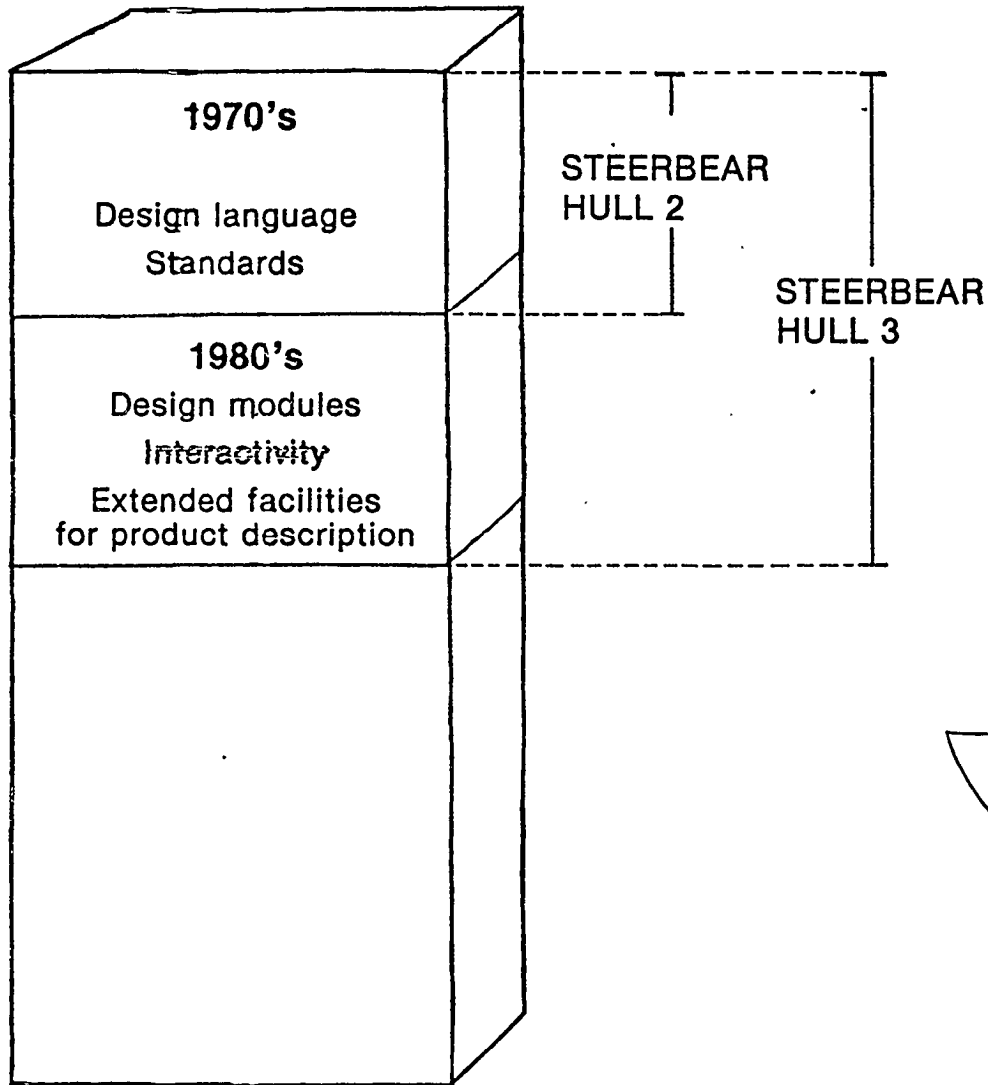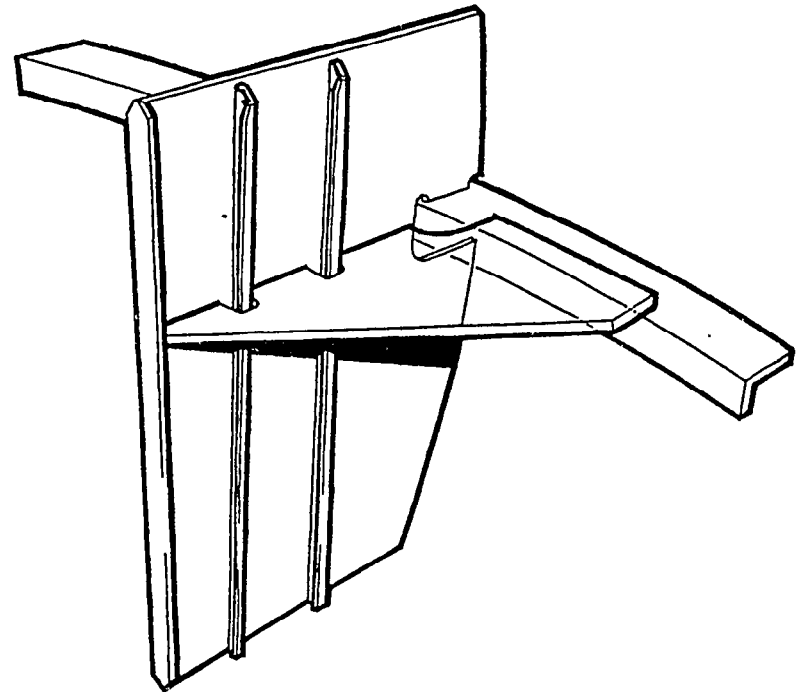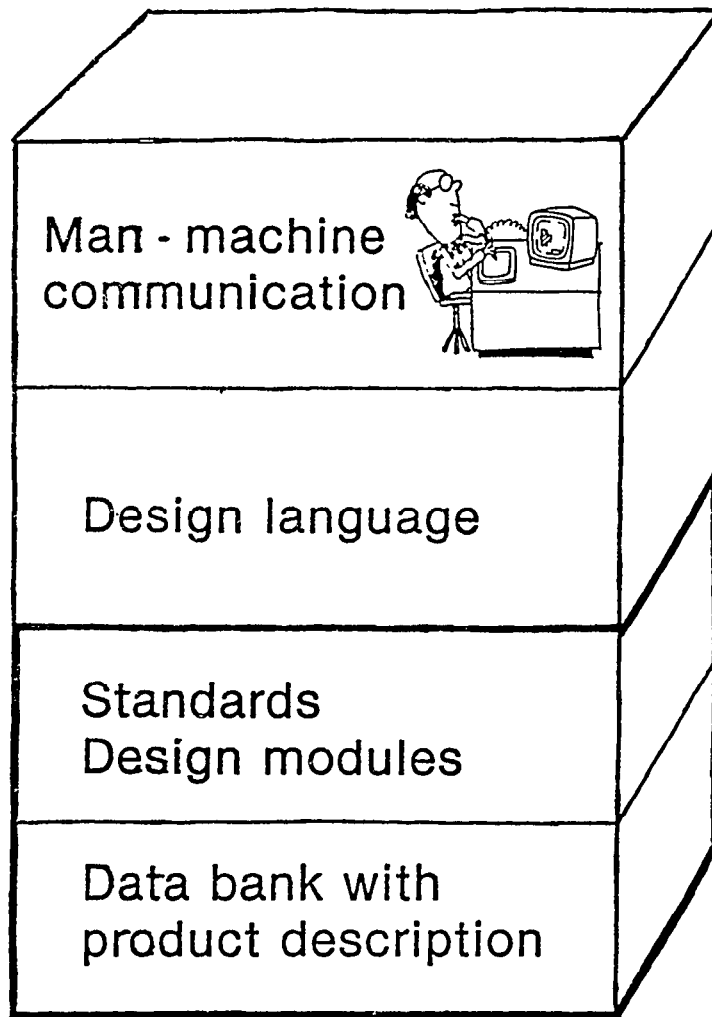
BRACKET, A, L27, AFT,
MTRL = 23, QUAL = B, POS = 124;

New Methods

PRODUCT DESCRIPTION:

Units

Panels
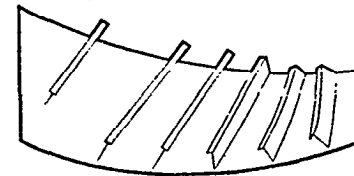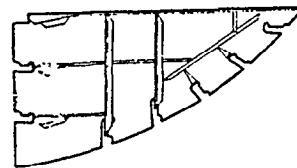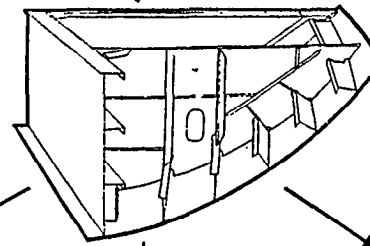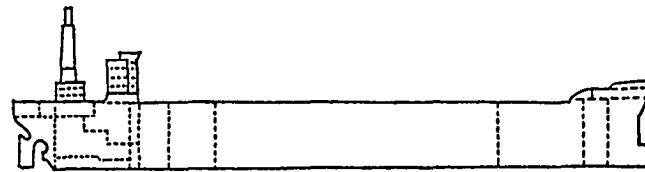
Absolute units, unique for each ship

DESIGN LANGU- AGE

RULES FOR:

Design modules

Standards

A

D
C
B

R

A

A

B

15
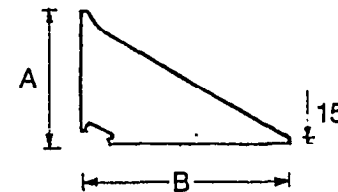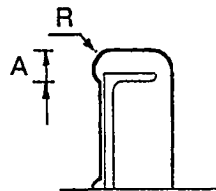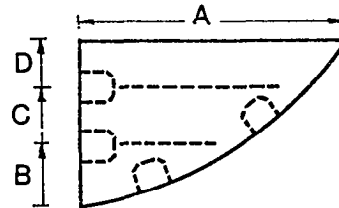
Parametric units, universal

Design Modules

Design
language

Para-
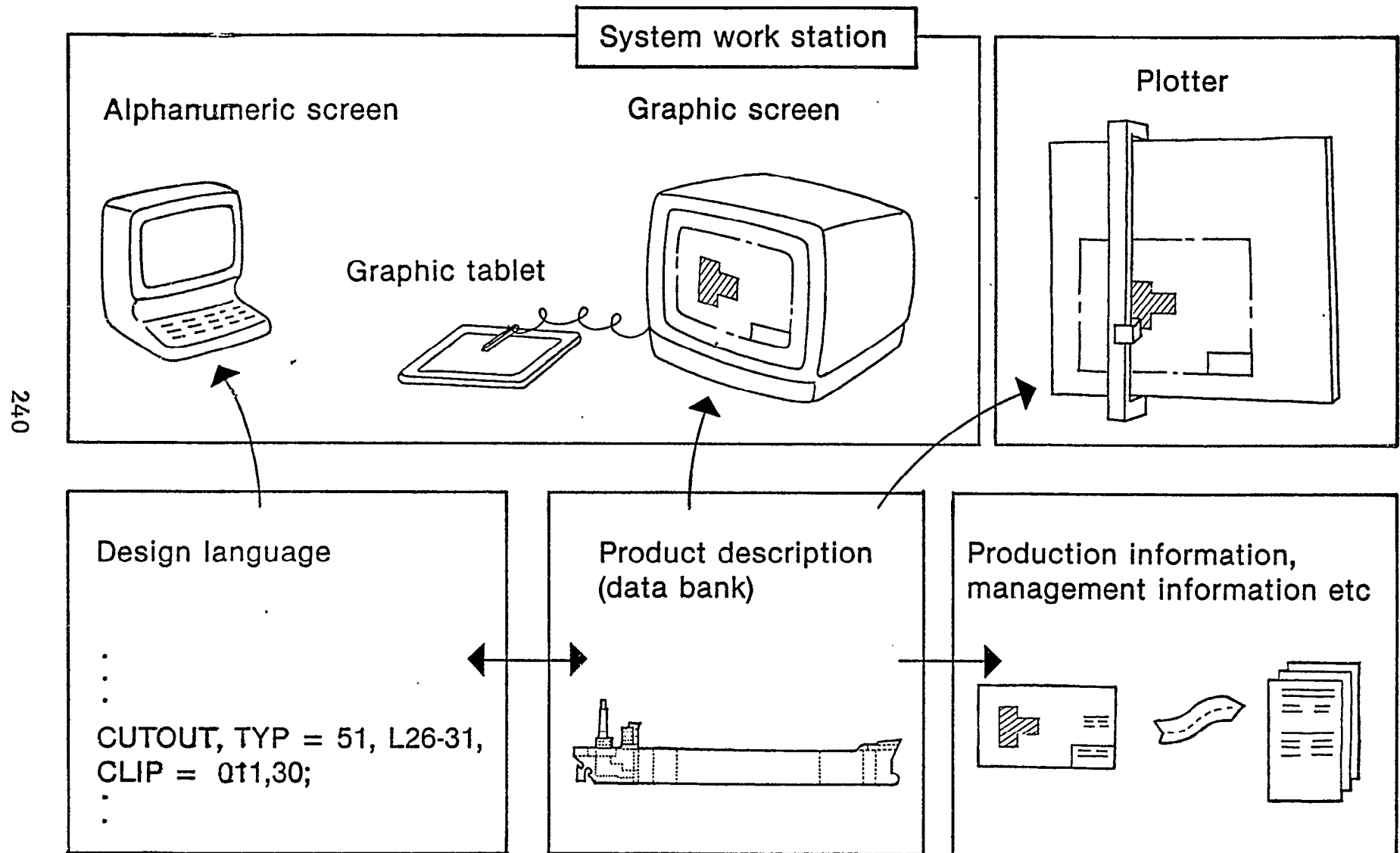meters,...

Design module

Principle
description of
a
bottom web
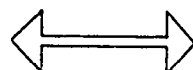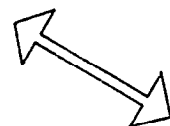
Surrounding
geometry
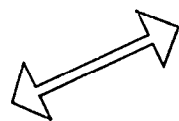
Standards
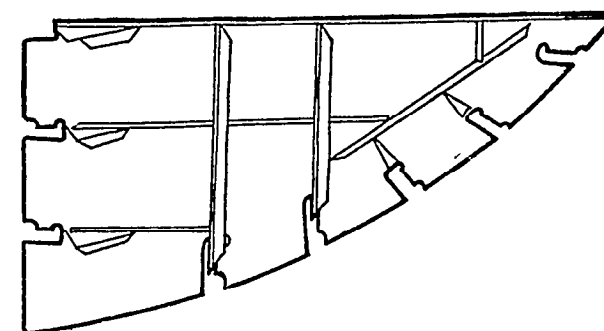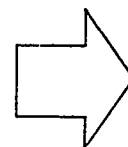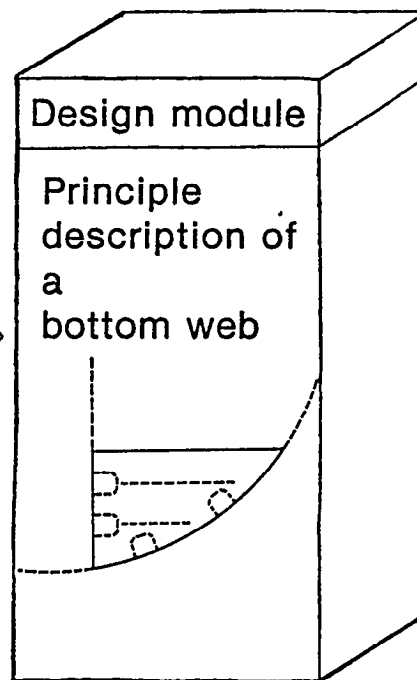
Unique bottom web

System Concept

System work station

Alphanumeric screen

Graphic screen

Plotter

Graphic tablet

Design language

.
.
.

CUTOUT, TYP = 51, L26-31,
CLIP = 011,30;

.
.
.

Product description
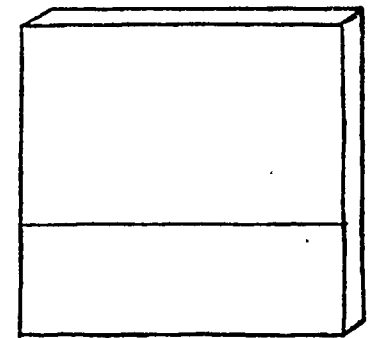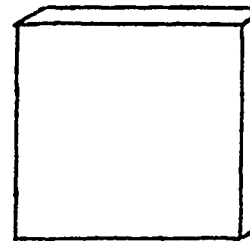(data bank)

Production information,
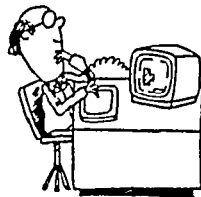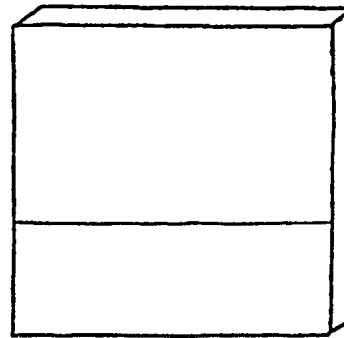management information etc

Hardware Configuration - Alternatives
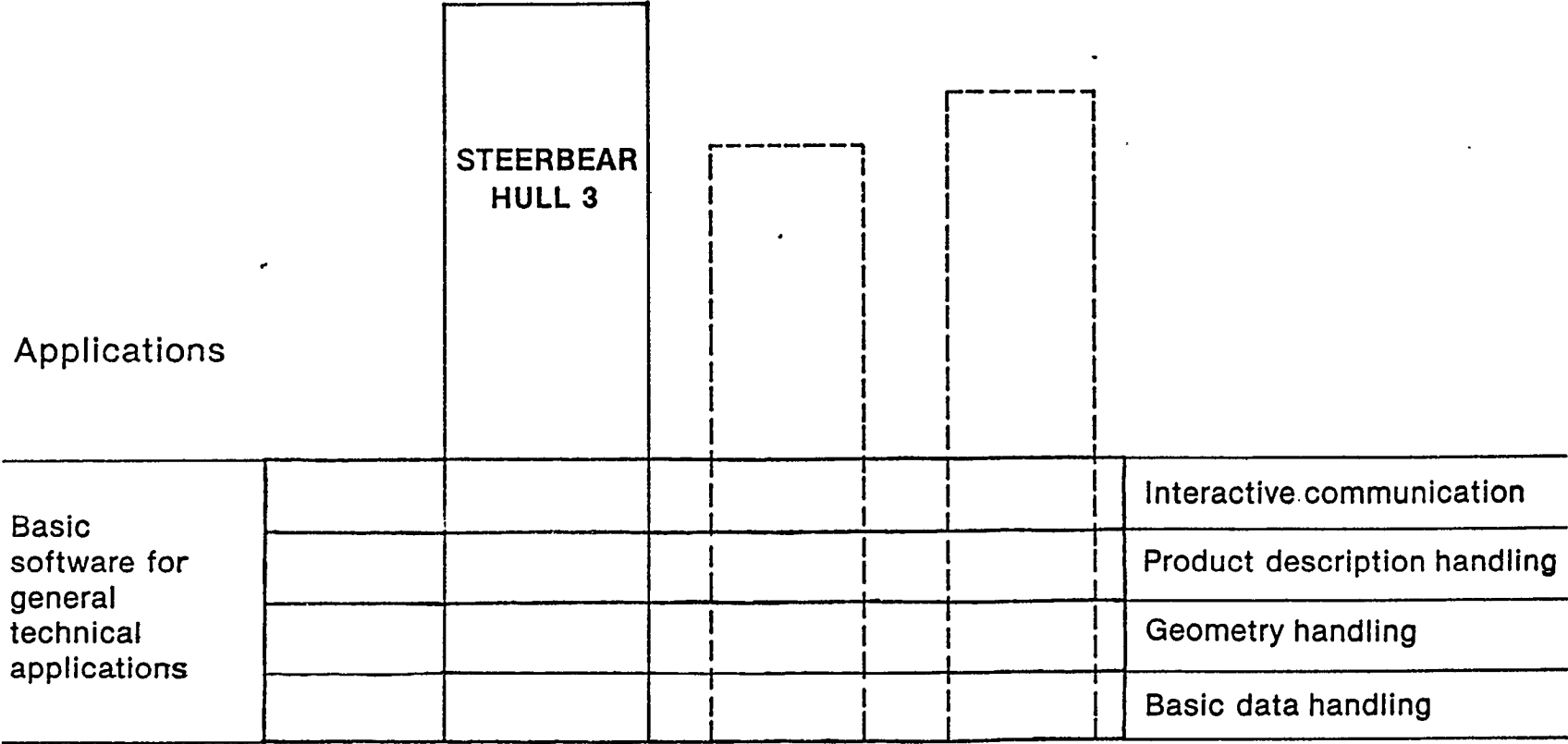
Main frame

Mini

System
work station
incl. micro
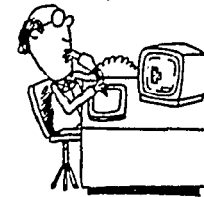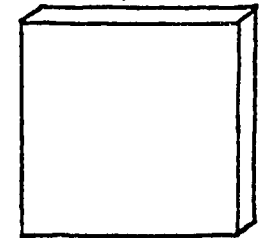
New Functions in STEERBEAR HULL 3

Material ordering, planning, etc.

Pre-design | Detailed design | Pro-duction infor-mation

Administration

Design & Production

├── STEERBEAR HULL 2 ──┤

├──── STEERBEAR HULL 3 ────┤

System Development

Applications

STEERBEAR
HULL 3

Basic
software for
general
technical
applications

Interactive communication

Product description handling

Geometry handling

Basic data handling
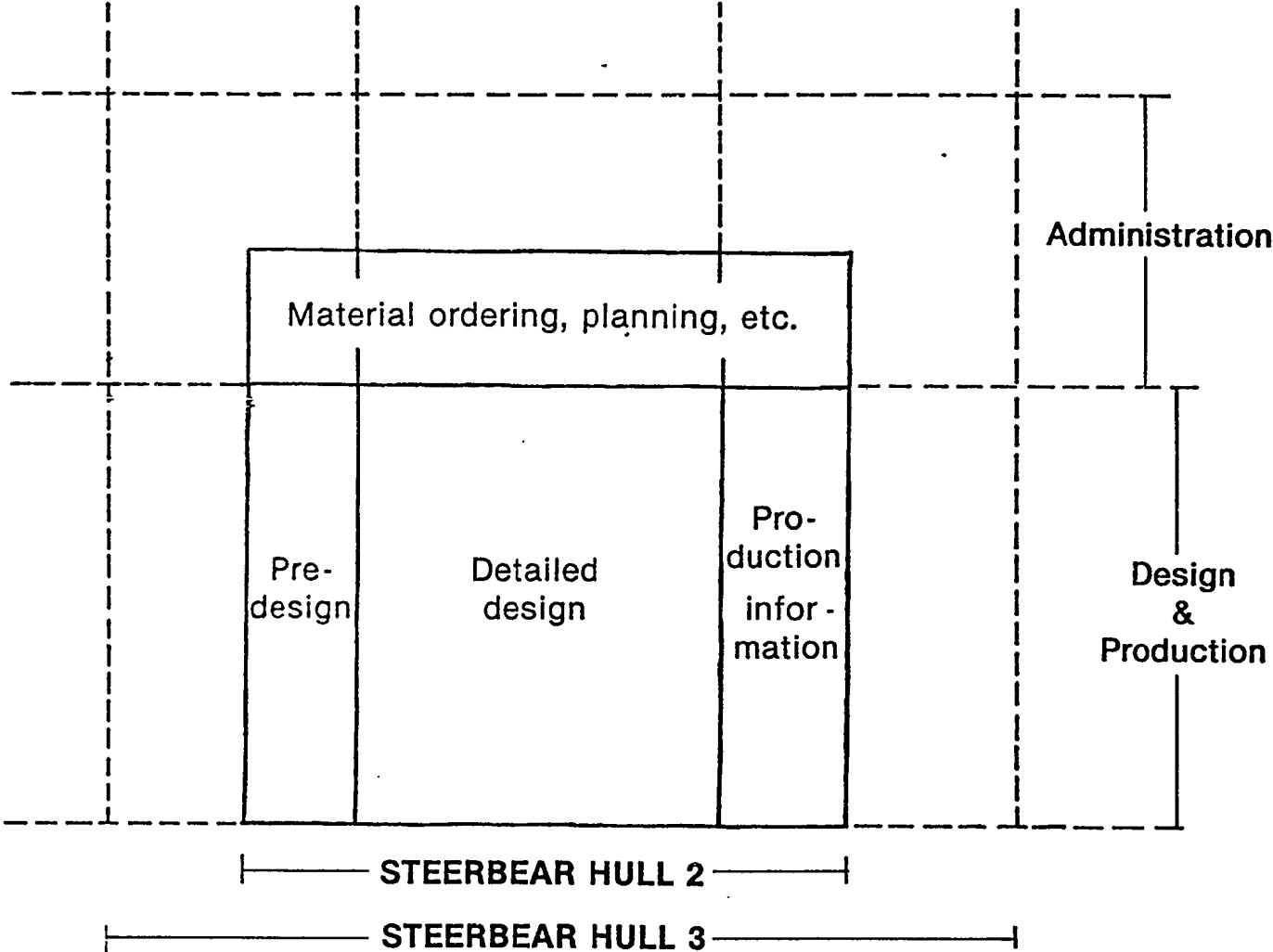
Implementation Schedule for
STEERBEAR HULL 3

System work station

Graphical RJE - station to STEERBEAR HULL 2

Working drawings for STEERBEAR HULL 2 and 3

Basic software

Structure generation

Fairing

Nesting

	1980	1981	1982

244
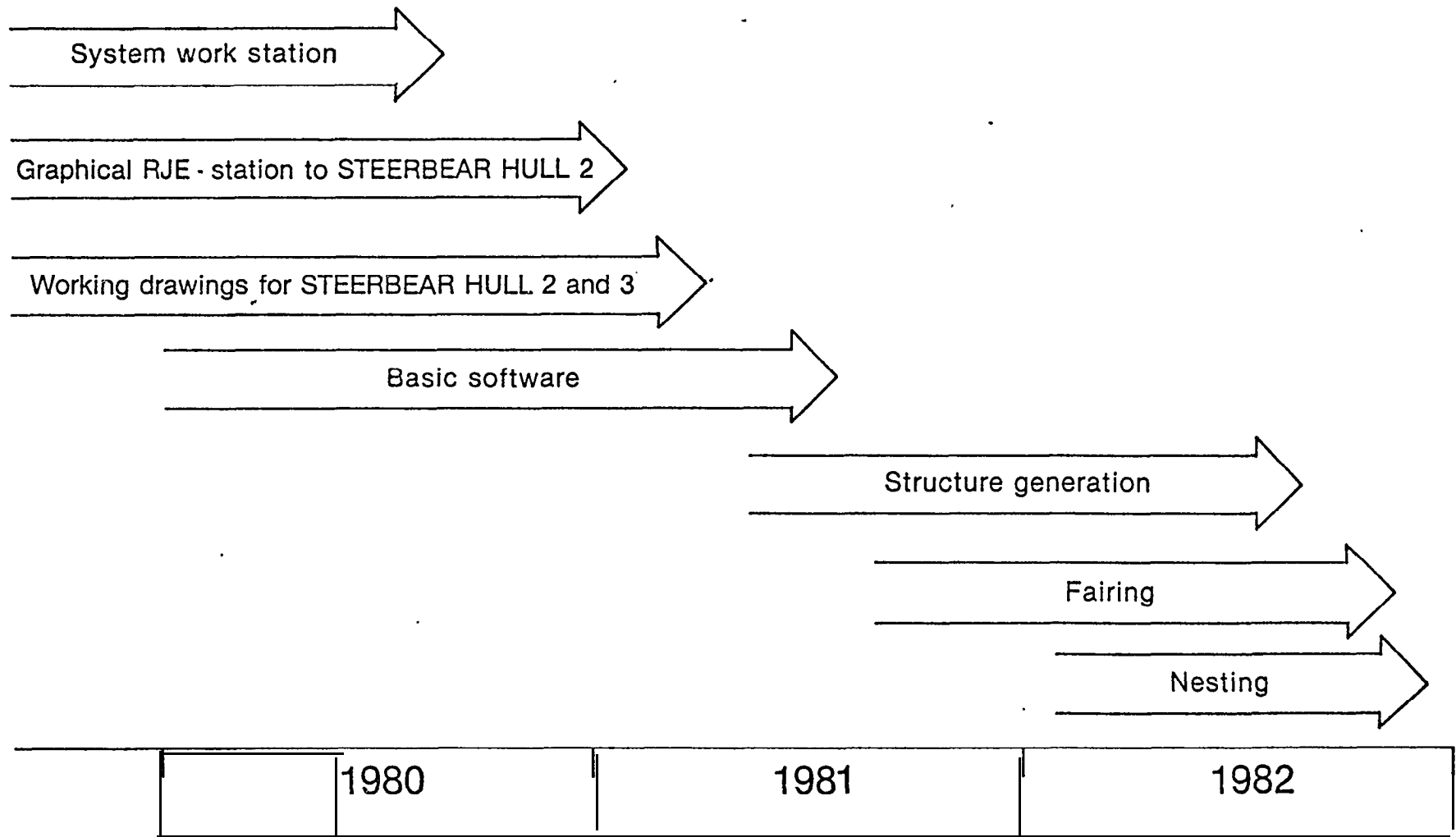
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